SOF
SCIENCE OLYMPIAD FOUNDATION

N S O
SOF NATIONAL SCIENCE OLYMPIAD

Total Questions : 50   Time : 1 hr.

PATTERN & MARKING SCHEME			
Section	**(1) Physics & Chemistry**	**(2) Achievers Section**	**(3) Mathematics or Biology**
No. of Questions	25	5	20
Marks per Ques.	1	3	1

SYLLABUS

Section – 1 : *Physics* : Units and Measurements, Mechanics, Properties of Matter, Heat and Thermodynamics, Oscillations, Waves.

Chemistry : Some Basic Concepts of Chemistry, Structure of Atom, Classification of Elements and Periodicity in Properties, Chemical Bonding and Molecular Structure, States of Matter, Thermodynamics, Equilibrium, Redox Reactions, Hydrogen, The s-Block Elements, The p-Block Elements (Groups 13 and 14), Organic Chemistry - Some Basic Principles and Techniques, Hydrocarbons, Environmental Chemistry.

**Section – 2 :** Higher Order Thinking Questions - Syllabus as per Section – 1.

Section – 3 : Sets, Relations and Functions, Principle of Mathematical Induction, Logarithms, Complex Numbers & Quadratic Equations, Linear Inequations, Sequences and Series, Trigonometry, Straight Lines, Conic Sections, Permutations and Combinations, Binomial Theorem, Statistics, Mathematical Reasoning, Limits and Derivatives, Probability, Introduction to 3-D Geometry.

OR

Section – 3 : Diversity in the Living World, Structural Organisation in Plants and Animals, Cell : Structure and Functions, Plant Physiology, Human Physiology.

PHYSICS AND CHEMISTRY

1. Three particles P, Q and R are at rest at the vertices of an equilateral triangle of side s. Each of the particles starts moving with constant speed v. P is moving along PQ, Q along QR and R along RP. The particles will meet each other at time t given by
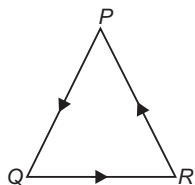
(A) $\dfrac{s}{v}$ (B) $\dfrac{3s}{v}$

(C) $\dfrac{3s}{2v}$ (D) $\dfrac{2s}{3v}$

2. A boy throws a table tennis ball of mass 20 g upwards with a velocity of u_0 = 10 m/s at an angle θ_0 with the vertical. The wind imparts a horizontal force of 0.08 N, so that the ball returns to the starting point. Then, the angle θ_0 must be such that, $\tan \theta_0$ is

(A) 0.2   (B) 0.4
(C) 2.5   (D) 1.2

3. A weight is attached to the free end of a sonometer wire. It gives resonance at a length 40 cm when it is resonanced with a tuning fork of frequency 512 Hz. The weight is then immersed wholly in water, the resonant length is reduced to 30 cm. The relative density in which weight suspended is

(A) 16/9   (B) 16/7
(C) 16/5   (D) 16/3

4. Given that 10 g of a dibasic acid (mol. mass =100) are present in 500 mL of the solution. The density of the solution is 1.02 g mL^{-1}. Match the entries of column I with appropriate entries of column II and choose the correct option.

	Column I		Column II
a.	Normality of the solution	p.	0.98
b.	Molality of the solution	q.	0.996
c.	Mole fraction of solvent	r.	0.2
d.	Mass fraction of solvent	s.	0.4

(A) a-p; b-q; c-r; d-s
(B) a-s; b-r; c-q; d-p
(C) a-s; b-r; c-p; d-q
(D) a-r; b-s; c-q; d-p

5. Maximum enol content is observed in

(A) $CH_3COCH_2COOC_2H_5$

(B)

(C) $CH_3COCH_2COCH_3$

(D) CH_3COCH_3

6. In the reaction,
$$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$$
when 1 mole of ammonia and 1 mole of O_2 are made to react to completion

(A) 1.0 mole of H_2O is produced
(B) 2.0 moles of NO will be produced
(C) All the oxygen will be consumed
(D) All the ammonia will be consumed.

ACHIEVERS SECTION

7. A bob is attached to one end of a string and other end of which is fixed at peg *A*. The bob is taken to a position where string makes an angle of 30° with the horizontal. On the circular path of the bob in vertical plane, there is peg *B* at a symmetrical position with respect to the initial position of bob as shown in the figure. If v_c and v_a be the minimum speeds in clockwise and anticlockwise directions respectively, given to bob in order to hit the peg *B,* then ratio $v_c : v_a$ is equal to
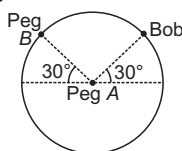
(A) 1 : 1　　　　(B) $1 : \sqrt{2}$
(C) 1 : 2　　　　(D) 1 : 4

8. A natural gas was containing mixture of methane and ethane only. On complete combustion of 10 litres of gas at STP, the heat evolved was 474.6 kJ. Assuming $\Delta H_{comb} CH_{4(g)}$ = –894 kJ/mol and $\Delta H_{comb} C_2H_{6(g)}$ = –1500 kJ/mol, the percentage of CH_4 and C_2H_6 will be respectively
(A) 30%, 70%
(B) 22%, 78%
(C) 72%, 28%
(D) 70%, 30%.

MATHEMATICS

9. Out of 800 boys in a school, 224 played Cricket, 240 played Hockey and 336 played Basketball. Of the total, 64 played both Basketball and Hockey; 80 played Cricket and Basketball; 40 played Cricket and Hockey and 24 played all the three games. The number of boys who did not play any game is _____.

(A) 128　　　　(B) 216
(C) 240　　　　(D) 160

10. The value of
$$\cos\frac{\pi}{15} \cos\frac{2\pi}{15} \cos\frac{3\pi}{15} \cos\frac{4\pi}{15} \cos\frac{5\pi}{15} \cos\frac{6\pi}{15} \cos\frac{7\pi}{15} \text{ is}$$

(A) $\dfrac{1}{164}$　　　　(B) $\dfrac{1}{138}$

(C) $\dfrac{1}{60}$　　　　(D) $\dfrac{1}{128}$

BIOLOGY

9. Read the given statements and select the correct option.

Statement 1 : Chloroplasts and mitochondria are semi-autonomous bodies.

Statement 2 : Chloroplasts and mitochondria have their own DNA and protein synthesising machinery.

(A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
(B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is correct and statement 2 is incorrect.
(D) Both statements 1 and 2 are incorrect.

10. Refer to the given graph.
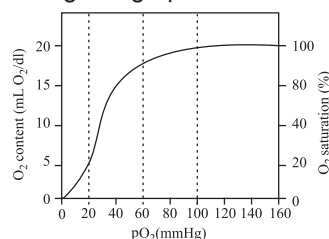
Under normal conditions, how much oxygen is transported to the tissues by blood on passing from lungs to tissues?

(A) 15 mL of O_2/100 mL of blood
(B) 10 mL of O_2/100 mL of blood
(C) 5 mL of O_2/ 100 mL of blood
(D) 20 mL of O_2/ 100 mL of blood

ANSWERS

(PHYSICS AND CHEMISTRY)　1. (D)　2. (B)　3. (B)　4. (B)　5. (C)　6.　(C)　7. (C)　8. (C)
(MATHEMATICS)　9. (D)　10. (D)
(BIOLOGY)　9. (A)　10. (C)